

## ABSTRACTS

### Air Travel Market Segments, A New England Case Study, Evelyn Addante

The 1995 American Travel Survey (ATS) is the first comprehensive survey of long distance travel patterns in two decades. The survey, conducted for the Bureau of Transportation Statistics by the Bureau of the Census, provides detailed information about the characteristics of long distance travel, including demographic information about the individuals and households who are traveling. It is, therefore, a useful resource for transportation planning purposes as well as travel market research.

This paper describes the results of using the New England region as a case study in air travel market research. Air travel market classifications are developed from the American Travel Survey data. The characteristics of the resulting market segments are explored in detail using additional information from the survey database. Some of the characteristics of the air travel market for New England are also compared to survey data available for Boston's Logan International Airport, the principal airport in the region.

### Preparing for the Long of It: Methodological Research for a European Survey of Long-Distance Travel, Kay W. Axhausen

Long-distance travel has in comparison with its share of trip making ( $\approx 1\%$  of all trips) a disproportionate impacts in terms of miles travelled, costs and subjective importance. The lack of a reliable and compatible public data base for this type of travel at the European level has held back policy making in a number of areas: development of the *Transeuropean Networks*, airport investment and regulation/deregulation of railroads and airlines.

The paper will concentrate on two areas: examples from current long-distance travel surveys in the member states of the European Union and a discussion of the results of some recent methodological research on surveys of long-distance travel funded by the European Commission.

A variety of recent national travel surveys (e.g. Austria, France, Sweden, Denmark, UK) have included long-distance travel, either in its regular questioning or in specialized extensions to the main survey. The paper will describe the methodologies used and present some key results in terms of amount of travel, modes used and distances covered.

The large differences in the survey methodologies applied and the resulting difficulties in collating the results into a coherent European whole have convinced the European Commission to support research into the development of a uniform survey methodology for long-distance travel, in the first instance. Two mayor activities were undertaken: a series of surveys undertaken by national statistical agencies and a pair of substantial research projects within the 4th Framework research programme. The paper will describe the research undertaken in both streams of work and discuss important substantive and methodological results.

The final section of the paper will present the current state of discussion about a possible EU-wide survey of long-distance travel behaviour.

## **NuStats International, Stacey Bricka**

The 1995 Nationwide Personal Transportation Survey (NPTS) and 1995 American Travel Survey (ATS) provide rich sources of data on travel in the United States. While the survey objectives differ, each provides a good foundation for further research into many different topics. The purpose of this paper is to identify regional variations in long distance travel in the United States as reported in the 1995 NPTS and the 1995 ATS. Specifically, the paper will seek to answer the question “How does long distance travel differ when we consider reports from respondents in geographically diverse regions of the United States, such as New York and Oklahoma?” This will be accomplished through comparisons of national and state level data collected through both studies.

Comparisons of reported long distance trips in each data set for pre-defined geographic regions will be performed in order to identify differences in trip length, purpose, mode, and demographic characteristics of the travelers. By focusing the analysis at the state level for geographically diverse areas, a comparison of results will show where regional variations in long distance travel exist.

In addition to comparing the data across geographic regions within each data set, this investigation will also, by default, look at differences reported in long distance travel between the two data sets at the national level. Given the differences in methods used to collect the data, some variations in long distance travel are expected. By using both data sets in this analysis, it is expected that any reporting shortfalls in one data set will be compensated by coverage in the other data set. The result expected from including both data sets in the analysis is a comprehensive picture of regional variations in long distance travel.

## **Identifying Passenger Corridors on the U.S. Highways System Using ATS Data, Shih-Miao Chin, Ho-Ling Hwang**

The 1995 American Travel Survey (ATS), conducted by the Bureau of Transportation Statistics (BTS), U. S. Department of Transportation, represents the most comprehensive survey since 1977 on the long-distance travel (100 miles or more one way) of persons living in the United States. Approximately 80,000 households were surveyed to collect information related to the characteristics of households and trips they made during 1995.

The ATS data provides detailed person and household long-distance travel information not only on a national basis, but also at state and metropolitan area levels. Data include trip origin, trip destination, travel purpose, mode of transportation, duration of the trip, as well as demographic information about the traveler. One of the main objectives of the ATS was to provide policy makers with more accurate and comprehensive information about the travel of residents in the United States.

The ATS data reveals that U. S. households took nearly 685 million long-distance trips in 1995. Over 95% of those trips, a total of 1 billion person trips, were to destinations within the United States. These trips, whether for business or pleasure, produced nearly 827 billion person miles on our nation's transportation systems. Only about 4 percent of total trips taken by U. S. residents in 1995 were to destinations outside of the United States. Approximately half of the 41 million person trips made to foreign destinations were to the neighboring countries of Canada (28%) and Mexico (23%).

Personal-use vehicles (PUV), which include car, van, truck, motorcycle, and recreational vehicles, were the dominant mode of transportation used for long-distance trips. They accounted for over 81% of the total person trips and 77% of the total household trips in 1995. This result reflects the widespread availability, convenience, and the relatively low operating costs of automobiles in the United States.

In addition to the comprehensive and accurate coverage of long-distance trip characteristics, the ATS data also include detailed geographic information. This information provides the transportation analyst with a unique opportunity to examine national inter-city highway travel patterns. These studies can support transportation planners in identifying inter-city highway corridors utilized by travelers. Together with other data sources, the ATS data allow transportation analysts to gain a better understanding about the operation and performance characteristics of these passenger inter-city highway corridors.

Under Title 1A, Section 1118 of the recently passed Transportation Equity Act for the Twenty-First Century (TEA-21), the U.S. Department of Transportation (DOT) is commissioned to establish and implement a National Corridor Planning and Development Program. Under this program, DOT is required to make funding allocations to states and metropolitan planning organizations for coordinated planning, design, and construction of corridors of national significance, economic growth, and international or interregional trade. Identification and understanding of national inter-city highway passenger travel corridors can contribute toward the completion of the National Corridor Planning and Development Program.

To understand the operational characteristics of inter-city passenger corridors is essential for the management of existing transportation facilities and for the planning of future investments. Sensible planning and development of transportation corridors can improve the mobility and accessibility to existing land use, mitigate unintended environmental consequence, as well as promote economic growth for cities and regions along the corridors. The planning and development of transportation corridors also provides a framework that enables city and regional planners or policy makers to precede, stimulate, and guide future regional land use along the corridors. Furthermore, by examining the operation and performance of the national inter-city highway passenger travel corridors, policy makers can be more informed in investing in new technologies. For example, this information could help to identify heavily traveled highway inter-city corridors where construction of a magnetic levitation railroad would provide better flexibility, better intermodal coordination, and a more efficient transportation system.

#### **Older Vehicles and Air Pollution: Insights from the 1995 NPTS, Jennifer Dill**

#### **Improving Air Quality Models in New York State: Utility of the 1995 Nationwide Personal Transportation Survey, Nathan S. Erlbaum**

The New York State Department of Transportation (NYSDOT) is legislatively responsible for the management of 14% of the 112,000 miles of public roads that carried 52% of the 118 billion vehicle miles of travel in 1996. These roads are comprised primarily of the Interstate and State Highway System which serve as the backbone for highway transportation in the state. As a state agency, the Department is concerned with many issues including infrastructure maintenance, safety, mobility,

economic development, congestion management, and air quality. The Department's capital program is multi modal with investments in public transportation facilities, as well as constructing, operating and maintaining the highway infrastructure. Its goal is to insure transportation access and mobility to all of its citizens.

This paper will describe several analyses of the 1995 Nationwide Personal Transportation Survey undertaken by the New York State Department of Transportation. These analyses are presented to illustrate the value of the Nationwide Personal Transportation Survey for New York State and the ability of NYSDOT to focus transportation studies on state-based travel characteristics. The analyses address issues raised by the New York State Department of Environmental Conservation (ENCON), the state's environmental agency, and the New York State Department of Transportation. They were identified during the development of the Air Quality State Implementation Plan, and related activities, such as creating vehicle miles of travel inventories, updating ENCON's emission model, and the conformity analyses of the Department's Transportation Program.

### **Influences on Mobility Among Non-Driving Older Americans, Edward L. Evans**

The 1995 National Personal Transportation Survey provides a snapshot of the daily travel patterns of a representative sample of the United States population. These data support the widely accepted notion that non-drivers aged 75 and older are among those most at risk for the social isolation and inadequate service availability that can follow from reduced mobility. This paper explores the factors associated with trip making among this group as they are reflected in the 1995 National Personal Transportation Survey. The analyses conducted here seek to identify those personal and community characteristics measured in the survey that are associated with trip making among the non-driving 75+ population. The profile that emerges suggests that beyond the constraints of physical and economic well-being, it is housing density and community context that most influence mobility among the non-driving 75+ population. Notably, when housing density is controlled, living in a central city area appears negatively associated with mobility among the 75+ non-driving population. The relationship between trip-making and central city residence suggests that perceived safety may influence mobility among this population. Transit availability does not seem to bear a significant role in mobility among this group when other factors are controlled.

### **Understanding Automobile Ownership Behavior of Low-Income Households: How Behavioral Differences May Influence Transportation Policy, Alissa D. Gardenhire, M. William Sermons, Ph.D.**

Modeling household automobile ownership choices is a key component of travel behavior research and of travel demand analysis and forecasting. Typically, auto ownership models have not addressed the differences in automobile ownership behavior for different population segments. Low-income households are a population segment whose auto ownership behavior is particularly relevant for public policy concerning household mobility. When making automobile ownership choices, it is expected that all households, regardless of income, consider their own mobility needs, purchasing power, availability of alternate modes, and various characteristics of the urban environment. How do low-income households evaluate these factors differently than non-poor households, and how can these differences impact traditional transportation policies aimed at helping the poor? This research proposes to examine this question. Automobile ownership models of residential location choice are

estimated for samples of poor and non-poor households from the 1995 Nationwide Personal Transportation Survey. The analysis tests whether the automobile ownership choice behavior of low-income households is significantly different from that of middle- and upper-income households. The empirical analysis involves estimation of ordered choice models of automobile ownership and involves a criterion-based segmentation search methodology to explore the influence of race, gender, and life-cycle status on automobile ownership choice behavior. The results reveal that factors such as household income and residential density affect poor households' automobile ownership behavior differently than they do non-poor households' behavior. Specifically, poor households convert income into automobiles at a higher rate and convert larger adult household size into automobiles at a lower rate than non-poor households. The implication of these findings on public policy concerning the mobility of low-income households, including welfare-to-work policy, is discussed.

**An Analysis of the Long-Distance Travel Behavior of the Elderly and Low Income, Nevine Labib Georggi, Ram M. Pendyala**

This paper provides a detailed analysis of long distance travel behavior for two key socio-economic groups of the population - the elderly and the low income. The analysis utilizes data from the 1995 American Travel Survey that provides a rich source of information on long distance travel (i.e., trips greater than 100 miles) undertaken over a period of 12 months. The analysis focuses on comparing the elderly and the low-income groups of the population against other groups with respect to various demographic and trips characteristics. The travel behavior comparison includes an analysis by trip purpose, travel mode, travel distance, trip duration, and trip frequency. In addition, regression models of long distance trip generation are estimated separately for different groups to examine differences in trip generation propensity across the groups. The results show that both, the elderly and the low income, undertake significantly fewer long distance trips than other socio-economic groups. It was found that nearly one-half of the low income and elderly made no long distance trips in the one-year survey period. In addition, it was found that long distance trips made by these groups were more likely to be undertaken by bus and geared towards social and personal business activities. The paper discusses the implications of these findings in the context of transportation service provision and policy formulation.

**Using the NPTS and the ATS Together: A Case Study, Patricia S. Hu, Jenny Young**

In 1995, the U.S. Department of Transportation conducted two national travel surveys: the Nationwide Personal Transportation Survey (NPTS) and the American Travel Survey (ATS). The main focus of the NPTS was on daily travel. The NPTS also collected data on trips 75 miles or more one-way. The ATS reported solely on long distance travel that was to destinations 100 miles or more one-way.

Although both surveys targeted similar populations, there are several differences in their survey methodologies. For example, the time frame for NPTS respondents to report long trips was a **two-week** window - all long trips made by every household member during a pre-assigned two-week period were reported. On the other hand, the ATS required its respondents to report all long trips that ended during the **twelve-month** period from January 1995 to December 1995.

With the enormous wealth of information in both surveys, it is tempting to combine data from both sources in an effort, for example, to estimate overall personal travel at the national level. Before answering the question of “How to combine?” the question of “Can they be combined?” should be addressed first.

This paper reports on an examination of the issue of whether NPTS and ATS data can be combined. The question was addressed by first examining the comparability of the data sources. Comparability between the two surveys is established from the viewpoint of whether the resulting summary travel statistics categorized by trip purpose and travel mode are significantly different from each other. Since round-trips going to places at least 100 miles away from home are a common element in both surveys, this analysis is limited to those trips. If the statistics for these long trips are not comparable, then the analysis identifies reasons contributing to the differences. A simulation was undertaken to determine how different data collection time periods, which the two surveys used, impact final survey results. Finally, we offer recommendations to increase the data comparability between the next NPTS and ATS in the year 2000.

**Evaluating the Accessibility of U.S. Airports: Results from the American Travel Survey, Ho-Ling Hwang, Shih-Miao Chin, Janet Hopson, Felix Ammah-Tagoe**

The 1995 American Travel Survey (ATS), conducted for the Bureau of Transportation Statistics by the Bureau of the Census, is the most comprehensive survey of long-distance travel in the United States since 1977 (Bureau of Transportation Statistics, 1999). Trip and traveler information for all long-distance travel (i.e., 100 miles or more one way) was collected for approximately 80,000 U. S. households during the 12-month period of 1995. The survey collected detailed information on trip purpose, modes of transportation used, origin and destination, lodging type, and trip duration, as well as, demographic characteristics of travelers and their households. The ATS data provide policy makers the most accurate and comprehensive information ever available regarding long distance travel at both national and regional (state and metropolitan area) levels.

The major purpose of this study was to utilize the abundant information collected in the ATS to evaluate the accessibility of U. S. airports and to gain a better understanding of the pattern of air passenger traffic among competing airports. In this paper, no effort was made to use modeling approaches to study airport choices. Instead, the objective here is to utilize air travel data collected by the ATS to identify regional, socioeconomic, and demographic factors which influence airport accessibility. First, the ATS person demographic file is utilized to compare the demographic characteristics of persons who took at least one trip by air in 1995 with those persons who traveled exclusively by other modes. Characteristics of travelers are also compared to non-travelers (i.e. persons who took no long distance trips in 1995). This information is used to determine what demographic factors may influence whether travelers choose to (or are able to) travel by commercial air. Secondly, we use the more detailed ATS person-trip file in conjunction with data from the demographic file to determine which factors may affect the airport accessibility. Specifically, the following issues are addressed:

1. the geographic area served by selected airports;
2. variability of mode utilized by travelers to access selected airports;
3. the affect of trip purpose, duration and income on access mode;

4. rail access; and
5. egress mode chosen by travelers to selected metropolitan areas.

**Is it Necessary to Collect Data on Mobility and on Long Distance Travel in the Same Survey?, Jean-Loup Madre, Joëlle Maffre**

For nationwide households surveys, France and USA traditionally give a different answer to this question. In France, we have dealt with both topics in the same big and infrequent surveys (1981-82 and 1993-94). Because of the difference in the frequency of trips according to their length, we clearly need different instruments. For instance, in the last national survey conducted in France, we used:

- an interview concerning trips made the previous day and during the previous week-end and a 7 day car-diary for daily mobility,
- an interview about the previous 3 months + a self-administered questionnaire for journeys, where at least one destination was more than 80 km great circle distance from the place of residence. This standard threshold has to be discussed.

The main advantages are:

- the general description of the household, of its members and of their vehicles has only once to be done,
- the information collected can be cross-checked (for instance, the mileage is controlled with the odometer in the car-diary, which allows the discussion of the perception of trip-distance).

The main draw-back is clearly that the survey is too long (1 H 30 on average), which means that only one person can be interviewed for daily mobility and one person (the same one in only half of the surveyed households) for long distance travel.

The analysis of overall mobility was first conducted by clustering trips according to their characteristics (mode, purpose, day of the week and duration). Some of the classes are typical of local mobility (school trips by public transport) or of long distance (leisure journeys by air), but others are mixed professional trips by train or car). A second clustering analysis is implemented on individuals according to the distribution of their trips in these different classes.

**Long Distance Travel by Low Income Households, William Mallett**

Local transportation mobility problems among low-income households are relatively well researched (Rosenbloom, 1995a, 1995b; Murakami and Young, 1997), but much less is known about intercity (or long distance) travel by these households. While not as important as daily local travel, long distance trips are often necessary to visit distant family and friends -- sometimes to take care of them (Wagner, 1997) -- to attend family functions such as weddings and funerals, and for rest and relaxation, sightseeing, and other personal recreational and developmental needs. Such travel is particularly acute

around the Thanksgiving, Christmas, and New Year's holidays (USDOT BTS, 1997). Business travel is another important component of long distance travel.

The dearth of research on long distance travel derives in part from lack of data, a problem overcome with results from the 1995 American Travel Survey. Conducted for the Bureau of Transportation Statistics by the Bureau of the Census, the ATS collected information on the origin, destination, volume, and characteristics of long-distance travel from approximately 80,000 households in the United States in 1995. This paper examines the long distance travel behavior of low-income households in comparison with higher income households using the American Travel Survey. The paper begins with a description of how households were classified into income groups and the demographic and geographical characteristics of low-income people. This is followed by an analysis of the travel behavior of individuals from low income households. Because a disproportionate share of people in low-income households are children and the elderly (65 or older) and these groups travel less than adults under 65, the paper includes a separate examination of adults under 65, adults 65 and older, and children.

**Redesign of the Dutch Travel Survey: Response Improvement**, Ger Moritz, Werner Brög

Non-response in the Dutch National Travel Survey (Onderzoek Verplaatsingsgedrag - OVG) has been a matter of great concern to Statistics Netherlands in the last years. A continuing downward trend in the response level has resulted in an overall response of less than 35% in 1998.

A task force investigated the possibilities for improvements and recommended performing a test using the integral 'NEW KONTIV DESIGN (NKD)' from Socialdata (Munich). Statistics Netherlands in co-operation with Socialdata tested this design in September 1997 ("Glass House"-project). The NKD resulted in significantly higher response-rates and better coverage of the target population compared to the OVG-design. In March 1998, Statistics Netherlands started implementing the NKD. During 1998, both designs (OVG and NKD) were conducted in parallel.

Developments in the OVG since 1985, results of the NKD-pilot in September 1997 and the first results of the parallel running are the themes of this paper.

**Redefining Conventional Wisdom: An Exploration of Auto Ownership and Travel**

**Behavior in the U.S.**, Deb Niemeier, Lorien Redmond, Jennifer Morey, Jamie Hicks, Patricia Hendren, Jie Lin, Erin Foresman, Yi Zheng

It is generally thought (Rosenbloom and Burns 1993a; 1993b) that primarily the poor have owned vehicles generating higher emissions (*i.e.*, older vehicles). However, the recent popularity of sports utility vehicles and light-duty trucks (as evidenced by the increased in annual fleet sales from 10-15% of the fleet in 1975 to 63% in 1993 (Sperling 1995)) has dramatically changed the composition of the US fleet. Recent trends show that sport utility vehicles, mini-vans and light duty trucks (SUV-VTs) are

progressively replacing passenger vehicles in the fleet. SUV-VTs now represent over half of all new personal automobile purchases (Bradsher, 1999).

The change in vehicle fleet composition raises several interesting questions. For instance, who are the primary drivers of these vehicles and for what types of trips are they being used? Anecdotal evidence suggests that SUV-VT's are used primarily for suburban driving, by parents taking children to an assortment of recreation activities. There are questions of equity associated with use of SUV-VT's. These revolve around such issues as assigning vehicle emissions to those producing the emissions, increased energy consumption, and the appropriateness of the CAFÉ standards.

In this paper we use data from the 1995 NPTS database to analyze the current fleet with respect to who are driving the vehicles, what types are trips are the vehicles being used for, and where is the primary accumulation of vehicle miles of travel (VMT) is occurring. Specifically, we explore three hypotheses. In the first, we hypothesize that relatively wealthy Americans are potentially responsible for a greater share of mobile source emissions and that certain proportions of VMT accumulation are related to gender differences. This implies that we expect to find households with higher incomes owning a disproportionate share of vehicles with low fuel efficiencies and/or higher emissions.

In our second hypothesis, we propose that a disproportionate share of SUV-VT travel is occurring in the suburbs and 2<sup>nd</sup> cities as opposed to the urban areas. As part of this examination, we explore how trip-making activities vary between the suburbs/2nd cities and urban areas, controlling for vehicle type and a variety of other factors, such as gender. An extensive body of research has identified gender as an important predictor of travel patterns. Among the major findings are that employed women tend to have shorter commute-to-work distances and times than employed men (e.g., Blumen, 1994; Hanson and Johnston, 1985; Hanson and Pratt, 1990) that women tend to spend more time in household and family support activities (Niemeier and Morita, 1996; Hanson and Hanson, 1980) and make more household and family support trips (Hanson and Hanson; Hanson and Johnston; Rosenbloom, 1987) and that women make fewer recreational trips (eg., Hanson and Johnston). Little is known about the vehicles women are using to conduct these activities.

Finally, for our third hypothesis we expect to find that SUV-VT's are used very similarly to passenger vehicles. For over 20 years, SUV-VT class vehicles have enjoyed exemption from the CAFÉ standards. The exclusion was justified on the basis that the vehicles were mainly used by small businesses for tasks such as transporting building materials on construction sites, which are directly related to livelihood. Since that time, clean air regulations have continuously allowed SUV-VT tailpipe emissions to be much higher on a per mile basis than those from passenger cars (Bradsher, 1999).

We have organized the paper around these three central hypotheses, exploring each in turn. At the conclusion of the paper, we offer a summary of our major findings as well as a brief commentary on the major policy issues.

**Enhancing Understanding of Non-Work Trip Making: Data Needs for the Determination of TOD Benefits** , John Niles, Dick Nelson

Many metropolitan planning organizations across the United States have embraced transit-oriented development (TOD) as their regional planning paradigm. Regional and local transit agencies have made -- or plan to make -- major investments in new transit capacity, particularly rail systems. These agencies expect that dense and mixed-use development around stations will follow and cause significant shifts away from automobile usage for both work and non-work trips. Federal transit support for construction of these new systems is conditioned on a showing of supportive land use patterns. And several separate federal initiatives have been mounted to encourage the integration of transportation with land development.

In spite of these unprecedented efforts, real benefits of TOD on a metropolitan scale remain problematic, in part because of the difficulty in estimating with sufficient certainty the market response to policies seeking major land use and transit system changes. In particular, the effect of TOD on non-work activities, from which a majority of all personal travel is derived, has not been thoroughly addressed. The analysis of travel for purposes of shopping, eating out, and recreation is complex because of the interplay of numerous variables that determine developer, store owner, and consumer reaction to transit investments, land use policies, and other government actions. New data and insights regarding the consumer marketplace are obviously needed to evaluate realistically the likely success of TOD and the expensive investments in new transit capacity that it requires.

A major effort to coordinate and cross-fertilize the Nationwide Personal Transportation Survey with other national surveys could provide a better understanding of consumer preferences, industry location decisions, and household activities that determine travel patterns. Marshaling the collective power of these surveys will help in setting pragmatic national, state, and local policy on transportation and land use, and in determining the most cost-effective allocation of federal and local transportation funds. The nation needs to take a comprehensive and systematic approach to data that do justice to the longer planning horizon implicit in the TOD paradigm.

**Long Distance Trip Generation Modeling Using ATS**, Wende O'Neill, Eugene Brown

This paper demonstrates how the 1995 American Travel Survey may be used to develop a long distance, non-business trip generation model using a cross classification approach.

**Estimating Long Distance Travel Behavior from the Most Recent Trip, Tony**

**Richardson, R.K. Seethaler**

In the United States and Europe, increasing attention is being paid to the measurement of long-distance travel behaviour. Such measurement poses special problems which are not encountered in the measurement of daily mobility in urban areas, which has been the focus of attention of most previous household travel surveys. Because long-distance travel is a relatively rare event, a major issue has been the selection of the period of observation. Unlike daily mobility surveys, where the most common survey period is a single 24-hour period, long-distance travel surveys have used survey periods from several weeks to several months.

However, selection of too short a period means that many respondents have no long-distance trips to report, while selection of too long a period means that frequent long-distance travellers have many trips to report, some of which occurred a long time before the conduct of the survey. This results in problems of recall or, in the extreme, problems of non-reported trips or even non-response. As a result, many surveys have used survey periods of 2 to 3 months. However, this method can result in under-reporting of trips from infrequent travellers, who are recorded as non-travellers, and possible under-reporting from frequent travellers because of the recall and response problems mentioned above.

In response to the above-mentioned problems, an alternative survey design is proposed by the authors which seeks to obtain information from all respondents about the most recent long-distance trip they have made, irrespective of when that trip was made. For frequent travellers that trip may have occurred today, while for infrequent travellers the trip may have occurred months or even years ago. Each respondent reports the details of only their most recent trip. In this way, trip information is obtained from all respondents, while limiting the response burden for the frequent long-distance travellers. The paper describes, theoretically and empirically, how the data obtained from this survey design can be used to obtain unbiased estimates of long-distance trip rates. It then compares these results with what would have been obtained from more conventional long-distance travel survey designs. It then suggests modifications to the basic design of long-distance travel surveys.

**Mobility and Mode Choice of People of Color for Non-Work Travel, Steven E.**

**Polzin, P.E., Ph.D., Xuehao Chu, Joel Rey**

This paper endeavors to contribute to the body of knowledge on travel behavior through a comprehensive look at mobility and the mode choice behavior of people of color for their non-work travel. Travel by people of color is of strong policy interest because it is a growing and changing share of the total travel market and is expected to continue to grow much faster than overall travel well into the next

century. The Nationwide Personal Transportation Survey (NPTS) provides a valuable data source for exploring these issues.

Understanding non-work travel is becoming increasingly important due to its growing influence people's lives and the transportation system. Non-work travel includes travel for personal and family business, school activities, religious activities, health care, and social and recreational activities. Work trip travel has declined to about 20 percent of all local travel. Even during traditional commuting rush periods, non-work travel comprises more than 70 percent of all trips. The resultant changes in both temporal and spatial distributions of travel in our metropolitan areas influence the types of transportation investments, services, and policies that can be used to address travel needs.

Mode choice determines how people travel and is an important part of travel behavior. This paper considers six mode choice options: driving privately-operated vehicles, riding in privately-operated vehicles as passengers, public transit, bicycle, walking, and others. This paper compares modal differences across groups by examining how patterns of difference in mode choice vary with personal, household, geographic, and trip characteristics. The exhaustive analysis examines a variety of distributions and tabulations and uses logistic regression to further explore mode choice differences between racial/ethnic groups.

The analysis indicates that the differences in non-work travel behavior for the various racial/ethnic groups has changed dramatically with minority travel behavior more closely matching mean behaviors. Mobility for minority travelers has increased and mode choice behavior, while still different, more closely resembles that of the aggregate population. Variations in aggregate group behavior can almost always be explained by socio-economic and geographic conditions. The most significant race/ethnicity-based difference appears to be a greater use of public transit by the Black population even when socio-economic characteristics of travelers are taken into account.

**Estimation of the Demand for Inter-city Travel: Issues with Using the American Travel Survey**, Piyushimita Thakuriah, Deepak Virmani, Seongsoon Yun, Paul Metaxatos

Inter-city travel occurs for a variety of reasons. Decision makers need to have an estimate of the demand for long-distance travel in order to assess the level of service and the capacity of service for inter-city travel by different modes. Further, estimation of inter-city demand may serve to identify markets for new types of service as well as to deliver transportation services that meet the preferences of travelers. This problem is not unlike the intra-metropolitan area demand estimation that is routinely done by planning agencies in order to assess modifications/enhancements needed in the area's surface transportation infrastructure. But important differences exist.

The major objective of this paper is to demonstrate a methodological approach to estimating the pattern of long-distance highway travel demand (between large metropolitan areas), using data from the 1995 American Travel Survey (ATS). Our objective is not to develop a final model for estimating inter-city travel demand. It is rather to obtain an understanding of the types of costs that travelers consider in making long-distance destination choices as well as the nature of the statistical challenges that arise in estimating such demand using the ATS data. The approach used leads to several important by-products. Foremost is the development of an approach that brings the estimation of inter-city travel demand by small area into the mainstream of travel demand modeling. Second, we would be able to estimate the changes in demand for travel between cities as a result of changes in costs of travel between cities. Further, the observed flow table (which gives the sampled counts of trips between each origin and destination metropolitan area) is likely to be 'jagged' in the sense that a number of OD pairs may have zero counts, whereas others have large counts. The process allows the smoothing of the observed inter-city flow table, which is important for the ultimate purpose of prediction (prediction is not considered in this paper).

If we consider metropolitan areas across the United States as long-distance traffic producing and attracting zones, then flows between these origin-destination zone pairs can be estimated by gravity models of spatial interaction. This is a class of models that has been applied to estimate various types of transportation flows --- the most common application in transportation being to estimate origin-destination (O-D) flow within a metropolitan area. While the model has been in use for a long time, there has been a fair amount of recent developments in both the formulation of a behaviorally-based probabilistic model as well as in the numerical procedures that are used to estimate model parameters. For example, the theoretical basis of this type of model was recently examined in Sen and Smith (1995).

We have selected the fifty largest metropolitan areas for this problem. Also, we have considered only travel by private highway vehicle mode for the following reason. While the ATS dataset is extremely rich in terms of traditional demand-side variables (such as detailed household-level information on trips, trip purpose as well as the household socio-demographics), applications of travel demand models have large appetites for supply-side variables, which are usually introduced into the models as costs. Except for distance traveled, other types of costs incurred by travelers in the ATS were not available from the dataset. Moreover, distances were available only for the observed inter-city trips in the ATS. But travel demand estimation requires distances between *all* (observed and unobserved) origin-destination pairs considered. Hence for the purposes of this paper, all cost or 'impedance' data (distances and travel times) had to be synthetically generated, which proved to be a time-consuming, resource-demanding exercise.

Travel costs that travelers respond to for intra-urban trips are well understood at this time. This is not the case for the costs or impedances associated with inter-city travel. Hence the approach taken in this paper is exploratory. We first introduced

into the model one impedance parameter and conducted statistical diagnostics, including examining good-of-fit measures. We then repeated the process for additional measures of impedance alternating between exploratory analysis, model specification, estimation and then diagnostics to understand the underlying patterns of inter-city trips. Further, travelers response to costs can be expected to vary by trip purpose, an issue we have considered in this paper.

Several unique challenges arise in using the ATS data to develop demand models. We have tried to address some of these challenges in this paper leaving the rest for future research. The paper is organized as follows: In Section 2, we briefly describe the data used. We describe the model proposed and the procedures used to estimate model parameters in Section 3. The special considerations that arise in using the ATS for demand models are described in Section 4. We present different scenarios for inter-city travel demand and the scenario estimation results in Section 5. Finally, we present our conclusions in Section 6.

**[The Use of Electronic Travel Diaries and Vehicle Instrumentation Packages in the Year 2000 Regional Atlanta Household Travel Survey](#)**, **Jean Wolf**, Randall Guensler, Simon Washington, Lawrence Frank

The Georgia Institute of Technology is currently performing research that will result in the development and deployment of three instrumentation packages that allow for automated capture of personal travel-related data for a given time period (up to ten days). These three packages include: 1) a handheld electronic travel diary (ETD) with GPS capabilities to capture trip information for all modes of travel; 2) a comprehensive electronic travel monitoring system (CETMS), which includes an ETD, a rugged laptop computer, a GPS receiver and antenna, and an onboard engine monitoring system, to capture all trip and vehicle information; and 3) a passive GPS receiver, antenna, and data logger to capture vehicle trips only.

The first two systems will be capable of capturing all travel activities that would normally be captured using manual travel diary or telephone survey methods. For each trip, this information includes vehicle or other mode identification, driver and passenger identification (for personal vehicle trips), trip purpose, start and finish time (or duration), origin location, destination location, and distance traveled. In addition to these traditional elements, route choice, functional classification of each link in the route, link-based travel speeds, and freeway traffic conditions can be determined by tying GPS data to a GIS database and real-time advanced traffic monitoring system, greatly enhancing the original data collected.

The comprehensive instrumentation system (CETMS) will also collect all vehicle and engine operating conditions affecting emissions that can feasibly be captured via an onboard engine computer monitor -- on a second by second basis. These data include such variables as vehicle speed, acceleration, engine rpm, manifold absolute pressure, throttle position, catalyst temperature, gear selection, air/fuel ratios, and coolant temperature.

The third system, the passive GPS receiver and antenna, will be used with a subset of the household sample employing traditional paper diary methods. The GPS data will be used to compare actual versus reported trip data, allowing for the development of under-reporting and mis-reporting correction factors.

Upon completion of prototype testing and data collection in the summer of 1999, 27 ETDs with GPS, 27 passive GPS systems, and 5 CETMSs will be procured and assembled for use in the 1999-2000 Atlanta Regional Household Travel Study. The targeted sample size for the regional survey is 4000 households. Of this number, approximately 50 households will have at least one vehicle equipped with the full instrumentation package, including the handheld travel diary. An additional 270 individuals will be given the handheld travel diary only. Finally, an additional 270 households will have at least one vehicle equipped with the passive GPS system.

The samples selected for the instrumentation packages will be controlled for all standard survey variables, including household income, number of vehicles, number of parents, number of children, etc., so that a direct comparison can be made of survey results between automated data collection methods and traditional manual methods. Key elements for evaluation include the number of trips made (reported and unreported), trip start and finish times, trip origins and destinations, trip length, and travel route. GPS-captured route choice will be compared with reported routes from the manual recording 'control' group and possibly from the instrumented group using route recall data from post-survey interviews.

### **Cognitive Laboratory Approach to Instrument Design, Maria Youssefzadeh**

In a multi-cultural environment with different legal conditions and population structures it is necessary to develop a method which can deliver reliable and comparable data of a high quality to build up a database of European travel behaviour as an invaluable tool for policy makers. Recognising this necessity, the European Union commissioned the project MEST (Methods for European Surveys of Travel Behaviour). MEST aimed to develop a benchmark survey of long-distance travel behaviour, which can be applied across Europe with questions understood in all member states of the European Union, the prerequisite to the cost-efficient collection of data. A series of three waves of pilot surveys in various countries is the main tool to achieve this aim.

The first wave of pilots included extensive pre-testing of the survey instrument as well as the concepts that lie behind travel diaries in general. For these cognitive laboratory exercises, "think-aloud"-interviews, a method to study cognitive processes in respondents, were used. These type of interviews help detecting weaknesses of design, question wording and order and the respondents' involvement in the survey. The exercises of the first wave took place in the UK and France. Based on the results of the first wave's cognitive laboratories, the questionnaires were improved and tested in the second wave of pilots. Before the third wave of pilots started the improved instrument was again tested in cognitive

laboratories. This time only questionnaire pre-tests were undertaken in Portugal and Sweden.

The paper will report the results of the cognitive-laboratory exercises. It will present the improvements of the survey instrument based on the knowledge gained about the respondents' difficulties.

**The Influence of Consumer Culture and Race on Travel Behavior, Johanna P.**

**Zmud, Ph.D.**, Carlos H. Arce, Ph.D.

In this paper, data from the National Personal Transportation Survey (NPTS), the American Travel Survey (ATS), the Consumer Expenditure Survey, and the U.S. Bureau of the Census are used to examine the intersection of consumer culture and travel behavior, particularly as consumerism might influence differences in travel behavior by race/ethnicity. The data indicate that buying power and purchasing behavior among Blacks and Hispanics is increasing at the same time that the trips for consumer activities are nearing 50 percent of all trips made. Differences by race/ethnicity in travel mode and time of travel for consumer activities will significantly impact overall travel behavior patterns in major urban centers where Blacks and Hispanics are most concentrated. Finally, the social context of consumer activities among Blacks and Hispanics indicates that their trip making for consumer purposes will not be significantly influenced by e-commerce. This paper also suggests that coverage bias hampers analyses of differences by race/ethnicity using NPTS and ATS data.